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AIR WAR COLLEGE

RESEARCH REPORT

WHAT ARE THE RELEVANT KEY FACTORS TO BE USED DURING THE DECISION MAKING PROCESS FOR ACQUIRING A NEW WEAPON SYSTEM VS MODERNIZING AN EXISTING ONE?

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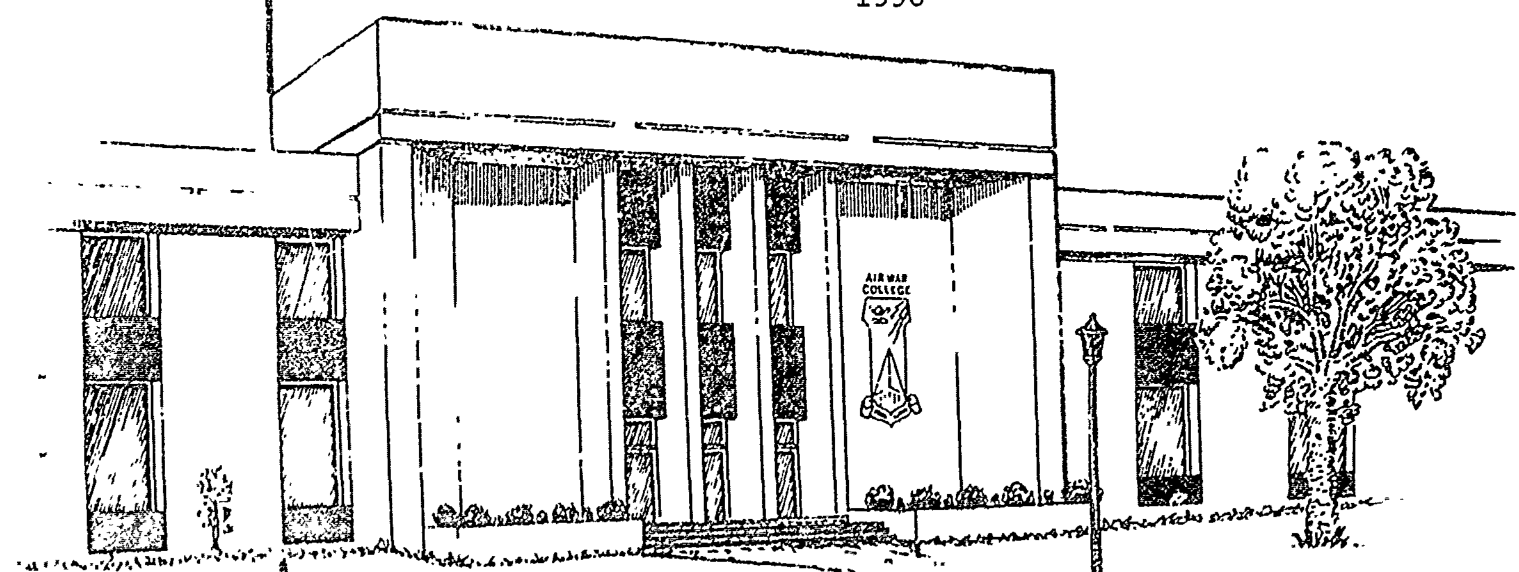

AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

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WHAT ARE THE RELEVANT KEY FACTORS TO BE USED DURING THE DECISION MAKING PROCESS FOR ACQUIRING A NEW WEAPON SYSTEM VS MODERNIZING AN EXISITING ONE

by

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A DEFENSE ANALYTICAL STUDY SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

Advisor: Captain Ricky K. Morris, USN

MAXWELL AIR FORCE BASE, ALABAMA

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EXECUTIVE SUMMARY

TITLE: What are the relevant key factors to be used during the decision making process for acquiring a new weapon system vs modernizing an existing one.

Rushing a weapon out of laboratory, through development and into production has been the most persistent feature of the weapons acquisition process.

The escalation in cost of new systems, the limiting factors imposed by the budget constraints and other practical considerations suggest a shift towards a different trend.

The Nation need not rush to stay ahead of the Soviets, nor is rushing the best way to place operationally useful weapons in the field. Besides the only way to achieve that goal is to not make it available to everybody else by putting it on the world market. Also, the Nation's approach to the modernization (how, when, in which entity) is directed related to when an hypothetical war is likely to occur: if war is unlikely in a short time frame, then the modernization will be the predominant policy; in the opposite case modernization is an incorrect policy.

The purpose of this paper is to find out and then to analyze the key factors (some of which are the ones mentioned above) that play an important and decisive role in the acquisition process, by examining some mistakes of the past, in order to avoid them in the future. The considerations outlined in the paper are essentially related to the USAF, but they are applicable to any NATO European Country.

BIOGRAPHICAL SKETCH

Colonel Ubaldo Serino, Italian Air Force, is a graduate of Italian Air Force Academy, class of 1967. He achieved his military pilot wings at Craig AFB in 1972. In Italy he flew mostly as an F-104 S pilot in several wings as squadron officer, squadron operation and training officer, flying safety officer, instructor pilot, and squadron commander. After his graduation at the Italian Air War College in Florence in 1984, he was assigned to the 5th ATAF NATO Headquarters as a staff officer in the Exercise Division, Plans and Policy Division, and than as executive officer to the Commanding General. Colonel Serino is a graduate of the Air War College, class of 1990.

CHAPTER 1

INTRODUCTION

"Money is not the sinews of war, although
it is generally so considered . . . .
It is not gold but good soldiers that
ensure success at war!"
Machiavelli, XV Cent.

The acquisition of a major weapon system, such as an aircraft, is a costly and long term effort, often requiring the commitment of billions of dollars over a period of years.

Normally the requirements are laid down years in advance of when the equipment will be delivered to the units. In the meantime technology changes and the potential enemy could revise his battle forces, or his strategy and tactics. That means that what was a valid requirement can become an obsolescence.

Neither it is possible to modify while the weapon system is under construction, because when industrial toolings have been built, when metal has been cut and thousands of assemblers have been hired, modification becomes disruptive!

Thus, for obvious reasons, the requirement must be clearly drawn, or if we could put in this way, should have a high degree of rigidity. But this rigidity is one of the shortcomings of the requirement process. Needless to say that, despite of the interaction between the developer, the user and the policymakers during weapons development, the events, the evolving strategy, and newer technology will outmode the initial project. The Department of Defense (DOD) has established a process to aid decision makers in dealing with these complexities and uncertainties. The process designates milestones (from 0 to five) at which decisions are required for major new systems. The Defense Acquisition Board (DAB) reviews the options available at each of the milestones points, and then recommends to the Secretary of Defense whether to proceed with a program as proposed (or with modifications) or to terminate the effort. Or it could be better an alternative solution, such as modernize the old system. But, how could we determine when is feasible to modify what we already have to meet emerging needs rather than developing entirely new systems? I do not pretend to be able to completely answer this debatable question. I think I can only analyze all the acquisition process and make some logical considerations on some peculiar "points of concern", such as:

- Has been the fashion of rushing weapons out of the laboratory, through development and into production, the most persistent feature of the weapons acquisition process?

- It is the user in the field or the technologist-turned-salesman in the laboratory who determines military weapons requirements?

- When glittering new technology comes on the scene, is there the temptation to build it for its own sake, and not because it is required to meet a national need?

- Are we sure we are not going to build a kind of "technological Maginot line" which will be "by-passed" in a real case by a very inventive, potential enemy of the future?

The pattern I will use to clarify the above points will be the following:

Examine the factors that generate a need and/or a requirement.

Examine the acquisition process.

Draw up the considerations as to modify or develop new systems.

Examine the role of the key players in the decision making process.

Therefore, the purpose of this paper is not to find a solution to a problem, even though it considers a very difficult and profound one, but to give a set of considerations and concerns which all the staff officers should know and be aware of when dealing with military procurement issues.

The information contained in the paper and the acquisition process examined are essentially related to the USAF system. But the principles outlined are applicable worldwide to the Air Forces' structures and especially to the NATO European countries.

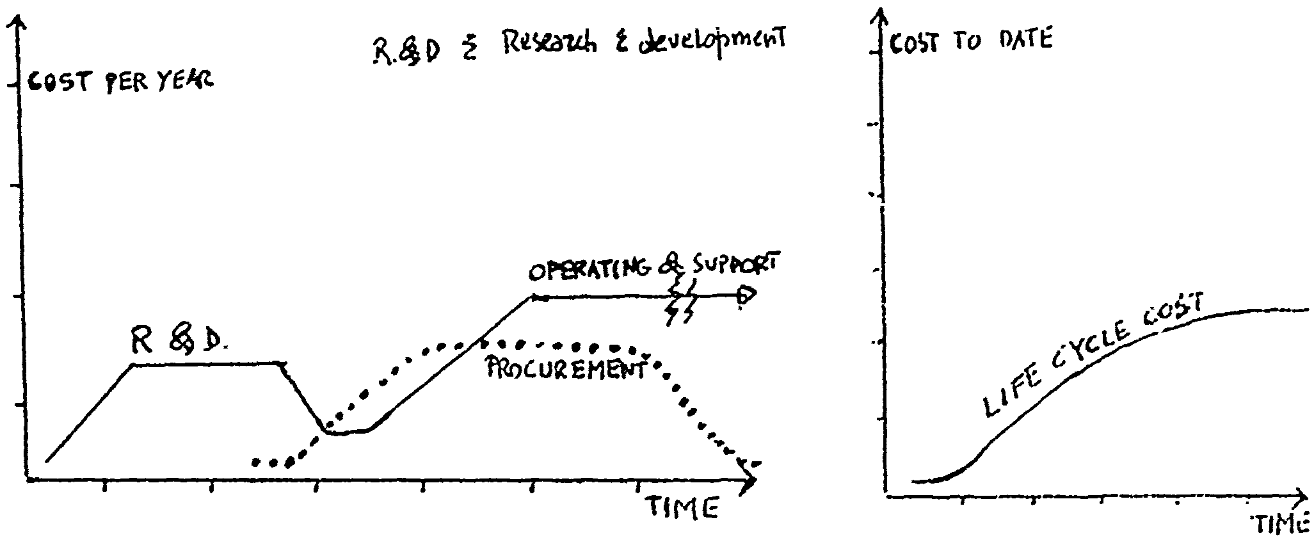
CHAPTER II

FORCES THAT GENERATED A NEED

"All other factors being equal,
numbers ultimately proved decisive."
Karl Von Clausewitz, XIX Cent.

1. Life Cycle Cost

This is one of the factors that would generate a need. As the figure below shows, much of the life-cycle cost of a weapon system is determined by the system's operating and support (O & S) costs, as opposed to its development and procurement costs (D & P).



If a weapons system is too expensive to support or we can not support it any longer (high life-cycle costs), the decision has to be made on whether to acquire or develop a new system. This decision must often be made early in the acquisition cycle, and specifically during the research and development phase. It is possible to make an extensive modification to a subsystem to extend its life. Examples are the F-111 Avionics Modernization Program (AMP), that replaces all of the F-111 avionics; the KC-135 reengining-replacing old engines with new commercial engines, in order to increase fuel efficency, allowing it to transfer more fuel to other aircraft than before. The KC-135 also has a AMP program. On the F-15 and F-16 the Air Force is doing block changes to improve life-cycle cost. This process is called the Multistage Improvement Program (MSIP).

2. Mission Area Analysis

A mission area analysis assesses the strengths and weaknesses of a military force when confronting a postulated threat in a specified scenario or set of circumstances.

What is desired? The mission area analysis supporting a Milestone 0 decision, and summarized in a Mission Needs Statement, shows either: a deficiency that threatens accomplishment of a national military mission and that therefore should be eliminated or reduced; or an opportunity arising from a comparative advantage that should be exploited to reduce risk, cost, or both.

What About the Threat and U.S. Capabilities? The mission area analysis included projections of the enemy threat. It describes the strengths and weaknesses of the forces and capabilities that potential adversaries could employ in the designated mission area, and shows how these forces and capabilities are projected to change over time. Changes in the threat are typically examined at least ten years into the future, and U.S. capabilities are projected at least through the end of the Six-Year Defense Program (SYDP)-funded delivery period (FDP), and further if circumstances warrant. The evaluation also considers how U.S. need would change as a result of changes in the threat. Additionally, it addresses the possible effects of countermeasures that adversaries might employ against the capabilities offered by each of the system alternatives being investigated.

Interrelationship of Systems. Individual systems generally cannot be evaluated in isolation. In this sense, the ecological principle that "everything is connected to everything else" applies with full force to mission area analyses. One must consider all relevant systems--and the synergisms and potential difficulties they collectively represent--on the battlefied of the future. Few deficiencies are resolved by just one system, and some systems can complicate the use of other friendly systems.

Multirole Systems. An increasing number of major defense systems can accomplish significantly different functions at different times. For example, an aircraft carrier battle group can support sea-lane defense operations against submarines one day and conduct long-range projection missions ashore the next. A fighter aircraft such as the F-16, can operate in a defensive counterair role one day and carry out an offensive "fighter sweep" into enemy airspace the next. Indeed, some systems can perform more than one such task at once. As appropriate, we should account for flexibility of this nature by investigating campaign-level operations over an extended period of time, rather than considering only the outcomes of representative tactical engagements.

3. Policy Change

Another important factor that could determine and influence the military acquisition process is a change in the national policy, that in turn is driven by the various changes in the international context.

Since sometimes the actual context produce scarce predictable outcomes, one of the most important tasks of our decision makers will be to foresee some potential development in the international environment in order to formulate well in advance the adequate answers in terms of National policy and doctrine.

An example of that is the most recent events happened in Soviet Union and in Eastern Europe. In fact some important decisions are going to be made in terms of defense budget cuts for the next few years, consequently the Research and Development Programs and the technological improvements will be affected by the decision.

4. Technology Advances

If technology were stable, the services would face the straightforward task of replacing old weapons only when they are worn out. But technology has long since ceased being stable, and today most important military technologies develop rapidly. If a breakthrough is made which would give us a superior combat advantage we may start a development program. This is especially true for a nation like the US, that stakes its security on technological advantage: it has every reason to field the newest and best technologies as quickly as possible.

Anyway, there are some problems arising from such practice (to buy first-hand technology) of which we will discuss later. Good current examples of this are in stealth technology and electronics. The Air Force developed the stealth technology in the late seventies and immediately began putting it into new systems such as the F-117 and B-2. The same is true for electronics: The Air Force developed VHSIC (Very High Speed Integrated Circuits) technology in the late seventies and immediately began putting it into the future F-16s and B-2s and cruise missiles.

CHAPTER III

THE ACQUISITION PROCESS

"War is a remarkable trinity composed
of its political objective of its
operational instrument and of its
popular passion."
Karl Von·Clausewitz, XIX Cent.

If we consider the technological
factor as the fourth element of
the Clausewitzian Trinity, the above
statements is still valid today

Once the need has been defined, the acquisition program will start trough its four fundamental phases.

Concept Exploration/Definition (CE/D)

Once defined the need, the first step of the program is towards the exploration of alternatives; consequently to ensure that all the altertive solutions are identified, a strong competition is required. Based upon lost, schedule, performance, and other parameters, an "ad hoc" team, lead by a program manger (PM), will select the best solution(s) to be continued into the next phase. Typical considerations that will influence the choice are the examination of the technologies that will be involved the program, the integrated logistic support, the cost estimating plays, the affordability, the total life-cycle costs, the costs of development and procurement. If at the end of the CE/D phase will be a matter of concern as well the feasibility of modifying a current system. It is designed to identify key program cost and schedule drives and assess the risks associated with the drivers.

2. Concept Demonstration and Validation (CD/V)

This phase may be the most critical to a program, since the service must select the best concept to meet the need and sometimes the decision is based upon limited data derived only from subsystems analysis and design; information about the total system may not be available. The activities related to this phase include subsystem prototype development testing, limited operational testing, planning and developing the logistic support system and updating plans started in the previous phase. The considerations are affordability vs military worth, operational suitability and effectiveness, program risk vs added military capability, planning for transition from development to production, manpower, personnel, training and safety assessment, procurement strategy, plans for integrated logistic support. If Low Rate Initial Production (LRIP) is part of the program's acquisition strategy, it may be approved in this phase as well. LRIP is a process whereby we begin to tool up for production so that we can perfect critical production processes before production begins. It is also tied to production of long leadtime items.

3. Full Scale Development (FSD)

In this phase the system is integrated from subsystems to a full-up system, so the risks analysis and control will receive close attention. In order to pass into the next phase the program manager must demonstrate that all technical operational resource requirements and threshold have been met and the risk has been reduced to an acceptable level. The Low Rate Initial Production tests the contractors ability to produce the system and to prove out the production line.

Some key activities that occur in this phase are: completion of development testing; system level operational testing; configurational control; completion of the system design; and corrections for problems that arise during testing.

Besides the team must demonstrate that the threat is still valid, the program responds to it, and the user still needs the system.

4. Full Rate Production/Deployment (FRP/D)

All the previous planning efforts needed to meet the biggest challenge for the program manager, the transition from full-scale development to full rate production of the system as rapidly as feasible within the constraints of available resources.

Key activities of this phase include: the monitoring of the manufacturing process and the contract, product and acceptance testing, activating the operational bases and the AFLC logistics support structure, and establishment of training activities. Strong configuration management control will be exercised and will culminate with completion of the physical configuration audit (PCA) on production items. PCA defines the actual operational and production characteristics of the deployed systems.

Product improvements to correct deficiencies discovered during testing, and preplanned product improvements developed during previous phases will be incorporated during this phase, either during the production run or as a retrofit to already deployed systems.

During all the previously examined phases, the Milestone's check-system which was mentioned in the introduction is widely applied from Milestone 0 to 5. Besides, the user and intelligence communities will be always involved in updating the threat documentation as the program progresses. These two practices give a certain degree of warranty in terms of system obsolescence when it will be fielded.

CHAPTER IV

CONSIDERATIONS AS TO MODIFY OR DEVELOP NEW SYSTEMS

> "Technology has not eliminated the need for operational effectiveness. This is as valid now in the nuclear age than it was in the second WW."
>
> Hartmann & Wendzel, XX Cent.

In case military organizations want to modernize rather than replace, they must balance the need to move quickly enough in order to capture a new technolgy's full benefits with the need to move slowly enough in order to make wise decisions. Modernization decisions thus pose dilemmas that are as complex and uncertain as the technologies with which they deal.

A useful metaphor for considering the dilemmas of modernization is the S-curve which charts the relationship between the effort put into improving a product or process and the results one puts back for the investment. The curve highlights an early growth phase when change comes quickly and return on investment is high, followed by a mature phase when investments are much more difficult and expensive.

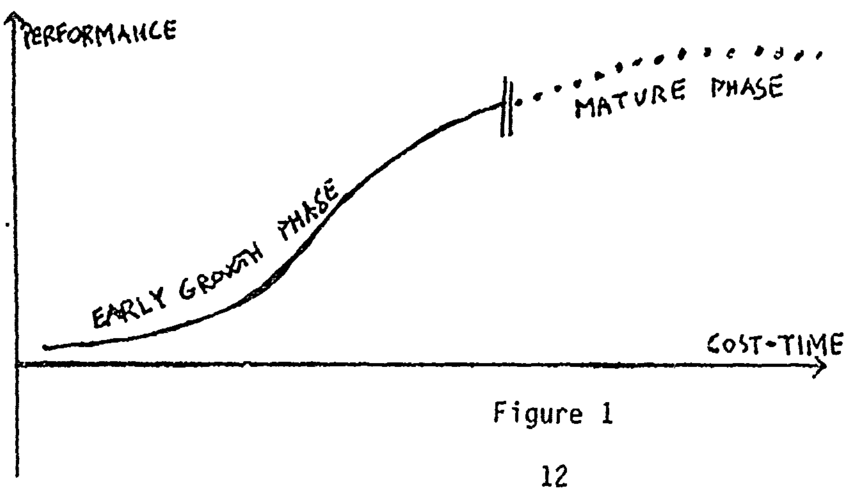


Figure 1

The S-curve may apply to specific technologies. Analysts at the Rand Corporation, for example, have produced something similar to an S-curve in measuring the pace of technological change in basic air airframe and engine performance in US Jet Fighter Aircraft. (See figure 2). As these analysts noted, "It has become increasingly difficult to sustain the rates of technological improvement that we have grown accustomed to in the past," suggesting the Jet engine and airframe system is entering its mature phase. Tank armor and engine technologies are also relatively mature. Performance improvements are still possible, but they come slowly and at great expense.

We recognize that those who rushed to buy the first hand-held calculators saw technological advances quickly push prices and size down, while performance improved. Many interested in buying a personal computer have been engaged in a seemingly endless waiting game, as prices fall while performance increases. As private consumers, we are probably more guilty of waiting too long than of buying too soon.

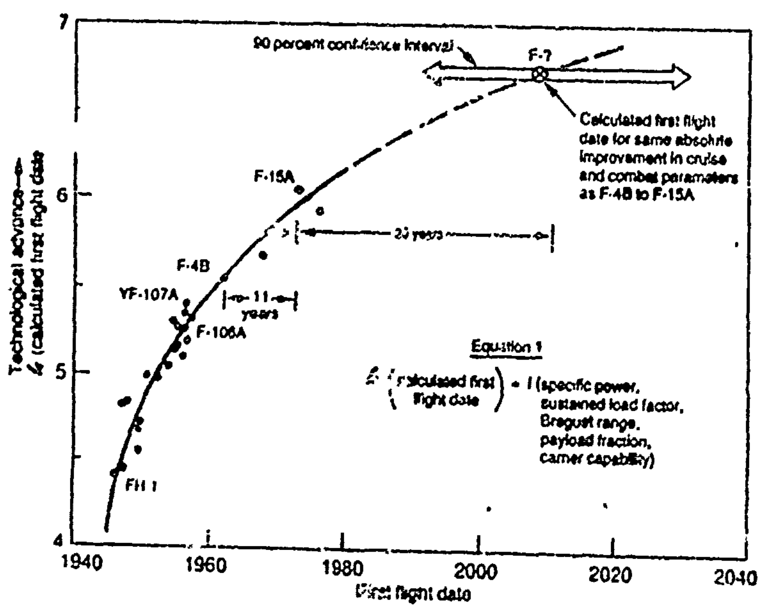


Figure 2. Technology Advace in Jet Aircraft over time.

Yet the nation countenances the opposite behavior from the Pentagon, presumably because the threat demands nothing but the best, and the quicker the better. Yet for defense technologies, no less than for commercial devices, getting something fast and getting the best (that is, the most cost-effective) are not the same things. The real question is whether the United States can afford to wait. The answer depends on how likely war is.

If the United States were convinced a war with a hypothetical enemy were certain to occur in, say, a year, the nation might forgo any further modernization, freeze units in their current configurations, train the force to its highest quality, and stockpile spare parts and munitions as quickly as possible. If war were certain to occur in, say, five years, the United States would probably find the best of the new technologies, deploy them to the force over the next three years, then spend the next two years training the force on the new equipment while, again, the nation purchased munitions and spare parts to operate the force in combat. Finally, if the United States were certain that war would occur in ten or fifteen years, it would make sense to forgo modernization while the R&D community probed the technological horizon for several years. At some point the best of the available new technologies would be imparted to the force in time to allow for training and the purchase of spare parts and munitions. In short, when war is likely to occur has a direct effect on our approach to modernization.

No one can predict the future; however, there are pressures in this situation to rush new systems into production as if war were "just over the horizon"--that is, likely to occur just after the particular purchase at issue is completed. Fear of tactical surprise understandably compounds these pressures. But uncertainty at the strategic level make it not only wise but essential to modernize systematically and judiciously, neither hurrying the process nor passing up the chance to modernize when information confirms the wisdom of so doing. In particular, buying too soon on the premise that the threat demands it is likely to be costly and hence counterproductive to the long-term defense effort.

The problem is knowing when to buy. The costs of modernization can be great and not just financial in nature. Of course that may not always be the case. For example, a new digital fuel pump for a jet engine may be cheap (at least compared with the cost of the engine), barely noticeable in the logistics system, and undemanding on training or maintenance routines, since the device is merely replaced when it fails. At the other extreme, however, are important systems or components whose purchase may easily cost billions or tens of billions of dollars, and whose introduction to the force sets in motion a series of ripples as operators, maintenance crews, and logistics pipelines accommodate something new and different. Then modernization takes a temporary, but potentially great, toll on unit readiness and effectiveness, as well as on procurement budgets. For example, when the Air Force bought the F-100 engine for the F-15 and F-16, the contractor was asked to get the maximum performance out of the engine. To do this he had to take durability out of the engine and also use very sophisticated subsystems. One example of one of these subsystems is the unified fuel control. It initially took depots four months to fix one fuel control module. The service was eventually grounding aircraft for defective fuel controls. Finally the item was modified, but it took over three years to resolve this problem, and millions of dollars as well.

Another example is the B-1 defensive avionics. The service tried to build an avionics set that could do more than technology would allow it to do. After wasting millions of dollars the Air Force still does not have full capability in the B-1 electronics suite, let alone one that is operationally supportable.

Modernizing once in a particular sector of the force posture is likely to be good grounds for not modernizing again, at least soon because of potential problems as the examples above illustrated. Thus it is usually unwise to purchase a new technology while it is still in its early stages of growth, since the device or system purchased might very likely to be unserviceable when fielded too soon yet too expensive and widely deployed to replace immediately. At best, the nation would be stuck with an obsolete piece of equipment. It may also have fielded a flashy new device that lacks reliability or military usefulness. At worst, however, buying too soon--even if the basic technological choice is correct--will leave the nation's adversary with the perfect opportunity to move ahead technologically by jumping to a higher point on the S-curve. To add insult to injury, the adversary may even capitalize on development work done in the United States in making its modernization choice. Such is the advantage enjoyed by those who are second in the technology race. The leader in the technology race would be wise to wait until the technology has developed to the upper knee of the S-curve where most of its potential can be realized in the deployed system, and where at best the leader's adversary can achieve parity, not superiority, in the technology race.

A nation that possesses the best technology and the best scientists does not need to hold the most advanced or effective weapons. Moreover, the key issue is not how speedily the nation rushes new devices to the field, but rather the validity of choices about which technologies to push and at what rate. And because rushing restricts the information on which valid choices are based, the nation that rushes risks frittering away its technology lead in an uninformed dash to preserve it. Case studies suggest that, on the margins, that is precisely what the United States has done. These kind of errors are especially evident in electronics, where innovative new technologies have multiplied during the past two decades. On the one hand, the microelectronics revolution has opened such a promising new realm that pressure to move these devices to the field quickly is very intense. On the other hand, technological and operational uncertainties run high, making it essential to test thoroughly before production, not simply to "fly before you buy," but to "try operationally before you buy." Failure to do so means to rely on a technology whose field performance can be almost a disaster. It is not the laboratory-scale demonstration of some technical capability that proves difficult, but the eventual transition to operational utility. Science is not the obstacle, it is engineering; today we are facing a very serious "system integration" problem.

Let me give some examples to illustrate the point better. First the production of early models of the F-111 was haunted by the engine-inlet compatibility problem. To function, a jet engine needs high-quality air--air of predictable pressure, relatively free of distortion and turbulence. The quality of air running through the engine depends on what happens before it enters and as it is leaving. This flow depends on the shape of fuselage, inlet, and exhaust nozzles, and of course the aircraft's flight profile. Bad blending of these components can produce performance failures in an engine that otherwise performs exceptionally well in tests. Such was true of the F-111: the first 141 models suffered from stall problems at certain angles of attack.

Second, the interference between the ECM system's transmitters and receivers of the B-1B. As with any electronic device, each component gives off electromagnetic emissions. Placed in close proximity, electronic components often interfere with one another. Interference problems are more common as the Air Force demands smaller but more powerful electronic components. This problem caused the Air Force to request more than $400 million in additional development funding for FY-1988 and 89 for the B-1B program.

We have seen that as technology matures, performance improvements come more slowly and at higher costs. If we push the demand for more performance we may fall sometimes beyond technological feasibility and/or beyond reasonable design limits. The Air Force's F-100 Jet engine, developed between 1970 and 1973 as part of the F-15 project, is an example. When the engine failed is first military qualification test (MQT) early in 1973, it became clear that the required engine performance might surpass what was then feasible. But by that time the rest of the F-15 project was moving smoothly toward a November 1976 production deadline, creating enormous pressure to hold the engine's producer, Pratt & Whitney, to its contractual production obligations. The Air Force program office did so, but partly by derating a key part of the engine's MQT. Testing problems continued to surface, but by October 1973 the F-100 finally passed its MQT and was certified as ready for production.

The engine's problems did not suddenly disappear with production, however. Rather, durability problems plagued the F-100 throughout the rest of the decade. To some extent, they stemmed from unforeseen rigors through which pilots put the F-15. But the engine's problems were also rated to the fact that the Air Force misestimated the state of the art and continued to struggle for a level of performance not yet well within the realm of practicality.

The engine's development thus continued in the form of a major component improvement program, or CIP. The Air Force poured nearly $700 million into the program between 1974 and 1985. CIPs are not unusual. As J. R. Nelson asserted on the basis of his study of the life-cycle costs of jet engines, the development of engines beyond the MQT . . . is often more costly than the entire development program up to the MQT. Normally, however, the purpose of continued development is, as improvement implies, to improve the engine beyond original requirements. For the F-100, by contrast, the CIP sought merely to bring the engine up to standards specified in the original development contract.

Meanwhile the Tactical Air Force was forced to contend with unexpected and serious reliability and performance problems in fielded F-15s. Pilots were impressed with the F-100's exceptional power and responsiveness. But as the engine endured more operational use, it became more famous for its tendency to stall, especially when its afterburner was in use. While Pratt & Whitney struggled to find a design solution to this problem, the Air Force had to restrict the F-15s flight operations envelop to reduce the chance of a stall. As Robert W. Drewes said, "Inadequate technology was forcing pilots to fly the engine rather than the aircraft." Some problems were mitigated because the F-15 was a two-engine aircraft. By the same token, however, fear for the F-100s performance heightened as the decade progressed and the Air Force began to accept the F-16, powered by only one F-100, into its inventory.

Temperatures in the engine ran exceptionally high, especially during stalls, when the flow of cooling air through the engine diminished sharply. Perhaps more important, temperatures fluctuated sharply, as pilots put their aircraft through maneuvers not even possible in previous aircraft. Thus the F-100 experienced an unexpectedly high rate of component failure, especially turbine failure, which is often a euphemism for "engine blowup." The maintenance burden on line units was much higher than predicted, and operating costs rose accordingly.

Most of these performance and reliability problems were solved by the mid-1980s, which Air Force officials attributed to their service's successful effort to induce competition into the high-performance fighter engine business by bringing General Electric's F-110 into competition with Pratt's F-100 in the "great engine war." But it is difficult to distinguish the effects of competition form those produced by the F-100 CIP. Arguably the original F-X engine requirement place the F-100 several years head of its time. The derated MQT requirement imposed in 1973 may have been closer to performance that was technologically feasible at that time. By 1985 the engine's technology maturation curve had in this sense caught up with it--but only after a painful, expensive, and often dangerous decade.

The F-100 is only a single case. Yet it is the product of patterns of behavior common across the breadth of the acquisition process. Moreover, most of the rapidly changing technologies that services explored so aggressively in the 1950s are today like the jet engine--still at the core of the nation's force posture but more mature. If the services continue to demand even higher levels of performance from such technologies while rushing new designs to the field, the Air Force's experience with the F-100 engine is likely to be replicated across the force posture.

Summing up, it is clear enough that the most sensible way to preserve the nation's technological advantage is to separate mature from growth technologies. When appropriate, advances gained from new technologies can be integrated into the mature technology, resulting in an improved weapon. Such an acquisition strategy is often attributed to the Soviets. If the Soviets are overtaking the United States in technology and if, as the DOD states, the Soviets take as long as the US military to develop new systems, it must be because the Soviets do a better job of imparting product improvements to their force posture.

CHAPTER V

ROLES OF THE KEY PLAYERS

> - Mass increases destructive capacity and helps ensure the desired degree of destruction . . . .
> - Mass also saturates defenses . . . .
> - Persistence precludes enemy recovery . . . .
> - Air attacks must hit key enemy systems repeatedly and without respite. Air attacks must give the enemy no opportunity for rest or recovery. (AFM 1-1 March 1989.)
>
> If in the future war, we have to fight an outnumbering enemy by outlasting technology, we are still able to comply with the above doctrinary priciples? Even though quality counts for quantity, what about the attrition rate we will surely suffer? How long it will take to reintegrate our initial capability?

The following are the officials who come into the play of the acquisition process.

1. HQ USAF: Reviews final Statement of Operation Need (SON) created by MAJOCOMs. Reviews Mission Need Statement and forwards to Office of Secretary of Defense if a new start.

2. Warfighting CINC : Receives planning guidance (e.g. statement of their mission) through the Defense Guidance document. Reviews and prepares SON's for needed capabilities. Works through MAJCOMs and HQ USAF. Once Program approved for development, staff maintains contact with AFSC and AFLC to ensure system trade-offs are consistent with proposed use.

3. Major Commands (TAC, MAC,. . .): Also receives planning guidance (e.g. statement of their mission) through the Defense Guidance document. Coordinates with CINC in preparation of SON's for needed new capabilities. After SON validated, prepares the Mission Need Statement. Once Program approved for development, staff maintains contact with AFSC and AFLC to ensure system trade-offs are consistent with proposed use.

4. Support Commands:

A. AFSC: During the draft SON PHASE, SONs are sent to the plan directorate of AFSC and AFLC for their comments on available or near term technology that can support the need. Once the program is approved and a Program Management Directive (PMD) is issued by HQ USAF on a major program, one would expect the AFSC program office to have a cadre of logistics command and user personnel to ensure that supportability and useability are addressed. Program offices are not advocates for systems. All advocacy provided by the using command(s). Program offices do prepare cost estimates, budgets, schedules and risk assessments to support advocacy.

For a successful program, the program office must address logistics, supportability, maintainability, reliability, manufacturability, and applicability early in the concept exploration phase.

After Program Management Responsibility Transfer (PMRT) from AFSC to AFLC, AFSC may retain responsibility for high tech systems/subsystems, and may continue to be involved in the procurement of system upgrades and/or improvements. Generally if a new capability is needed after PMRT, AFSC is responsible. An example is the F(B)-111 and B-52 programs. They were PMRT'd many years ago but there remains program offices in AFSC today that are responsible for avionics modernization, ECM modernization, etc.

B. AFLC: During the draft SON phase, SONs are sent to the plan directorate of AFSC and AFLC for their comments on available or near term technology that can support the need. Once the PMD is issued, AFLC will assign a cadre of personnel to the AFSC program office. Throughout the acquisition process, these persons are directly responsible for identifying logistics, maintainability, reliability, technical manuals, support equipment, manufacturing reprocurement documentation, transportation, packing and handling requirements. They are also responsible for ensuring that these requirements are addressed throughout the process of contracting to have the system developed.

The PMRT will occur when the production item is well baselined, usually during the early production lots. The PMRT from AFSC to AFLC may be done all at one time or by phases and/or subsystems. There is no one time that every program will PMRT, each PMRT is negotiated and agreed to by AFSC and AFLC. After PMRT, AFLC sets up their own program office, and AFSC ships all desired documents and contracts to the AFLC PM. AFSC does n[illegible] assign AFSC personnel to the new AFLC program office.

Generally, after PMRT, AFLC will only develop new hardware for a system if they lose the ability to buy replacement parts or if there is a reliability/corrosion/other problem with a certain part. Even after PMRT, AFSC and AFLC maintain working relationships, usually through extensive TDYs to ensure that new capabilities are compatible with the fielded system.

Besides the official key players just above examined, many human and political factors come into the play when deciding on needs and the subsequent acquisition process, involving the military, the Congress, and industry, as well as public opinion.

The military outlook is naturally for "the best and in large quantities." Would we expect a request for second best in quality or quantity? In an American military, the request is typically for the most technologically advanced system, and the tendency is also to include incrementally new devices or variations even as a system moves forward into production. A weapon that fires more quickly, more accurately and more dependably may--probably will--win the engagement precisely because it is technologically advanced. However, we have previiously examined some points of concern for such a practice: the high capability mindset toward procuring systems produces more complexity than simplicity, and often results in design and manufacturing problems.

Besides, we all know that there are limits to the level of defense spending and to the size of the armed forces the American people will support in peacetime. Consequently military policymakers haye little choice but to seek a technological edge: the principal issue is what Admiral Zumwalt called the "high-low" question. High meant high cost but high performance when on line; low mean moderate cost, moderate performance and sometimes easier maintenance.

Let us now shift to industry's mindset. Industry deals with an executive branch that is characterized, both in the military and on the civilian side, by incessant change at the top levels of government. Administrations, chiefs of service, military officers come and go. Industry knows that its customers will rarely place an order and leave it at that. Even more important industry knows that because of the nature of the budget process, its customer cannnot guarantee the ultimate size or duration of any order placed. So in the competitive arena, industry often bid unrealistically low initially to procure the contract and then adding or padding in later segments of the order (by which time the executive branch officials will probably have changed).

Thus, there is the chronic problem of cost overrun. But on the other hand, very few major contractors are actually available to bid on and produce major American Defense Systems. In the aerospace area we can name General Dynamics, Rockwell, Lockheed, Northrop, Boeing, McDonnell

Douglas, and Grumman. Similarly, very few corporations are able and ready to build navy ships. So, government leadership may talk tough, but its options are highly limited.

This problem is even worse in Europe, where there is not any single national industrial corporation that could bid for the R&D of a new aircraft. The Tornado in fact, is a trinational program (UK, Germany, Italy) carried out by the three main national aerospace factories in the respective countries. The EFA (European Fighter Aircraft), will be manufactured jointly by the UK, Germany, Spain, and Italy.

Congressional policies, procedures and mind set constitute a third important factor. The redundancy in effort in the budgeting process, the endless scrutiny of the tiniest details of the administration requests and the lack of coordinated policymaking procedures make a systematic and coherent congressional approach to procurement almost impossible. Individual congressmen and senators have a solid grasp of the key issues, but Congress as a body is not well equipped to assess threats effectively and fashion procurement decisions from a long-term strategic perspective.

In this whole resources allocation process, the role of public opinion is, on the whole, not very important in the direct sense of determining budget outlays. However, it provides a set of boundaries and mark out general directions, such as whether spending should be increased, stay about the same or decrease. There is no doubt that the actual historical moment is directing the public opinion towards a significantly decrease on military budget.

CHAPTER VI

CONCLUSIONS

The acquisition problem will never be problem free, given its size and complexity. I tried in this paper to put together all the information that a staff officer should know on the subject, the pitfalls, the point of concerns, and the considerations based on different perspectives and perception.

So I examined the following points:

A. Factors that generate a need, such as the life cycle cost, the mission area analysis, changes in policy, and technology advance.

B. The acquisition process through its phases:

Concept exploration--when paper work studies are done to determine the best way to meet the system requirements; alternative concepts are developed and then trade studies are accomplished to pick the best alternative.

Demonstration validation, consisting in building laboratory models of the critical subsystems and testing them to see if they meet the mission requirements.

Full scale development, when prototype system is produced and tested, that means the complete commitment of the system's production.

Production and deployment of the systems and the beginning of operations.

C. Considerations as to modify or develop new systems. Taking in account the cost and the time available to develop a capability, I came up with the point that the best way to do things could be to modify as a short term partial solution and to develop new systems in the long term, avoiding the temptation (and trap) of to rush technologies beyond a certain edge. In this way it should be possible to prevent what it seems likely to happen, that is the services get useful product improvements too late, if at all, while they get unimportant projects far too soon. And to make matters worse the hardware that military units get may be inappropriate or at least unready. Then, I highlighted some serious built-in problems that stem from the mindsets of military, industries, Congress and public opinion.

D. Roles of the key players, who are:

HQ USAF, who ranks the requirement into the big picture, coordinates the requirement with all of the concerned players and add fiscal reality to the process.

Using commands--SAC, TAC, MAC, etc., who define the requirements, advocate the program, monitor the status of the development process, test the system to make sure that it meets requirements.

AFSC, who develops and produces the systems.

AFLC, who defines support requirements for the systems and works with AFSC during the development process to make sure that the systems are supportable when they fielded, and takes over management responsibility for the systems once they are operational.

I really hope this work, that is essentially a review of a process already well known to the experts and a collection of different points of view, will be of some help to the professional achievement of any reader in such a way to fulfill the requirements of our common allied military interests.

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